Developing Information Systems for Competitive Intelligence Support

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ABSTRACT

COMPETITIVE INFORMATION SYSTEMS (CIS) are multifaceted services that contribute to organizational decision making by providing information services in the traditional sense, but also, and more particularly, by collecting and analyzing data from primary sources. The continuous systematic CIS provides "intelligence information," exists within an organization's other information systems, and must be supported by all levels of an organization.

INTRODUCTION

Librarians and information scientists have long enjoyed gatekeeper status in their organizations, providing service as intermediaries between information and the people who need it. Changing information sources, technologies, management practices, and organizational cultures are transforming the role of intermediary to one of enabler, providing the mechanisms to supply quicker and more direct access to information. The development of competitive intelligence (CI) activities in companies has hastened this trend. This article discusses the issues connected with developing information systems for competitive intelligence support. It provides an overview of CI system elements, defines the elements of an effective competitive information system, and summarizes major issues affecting system design and implementation.
COMPETITIVE INTELLIGENCE SYSTEMS

A competitive intelligence or business intelligence (BI) system is the organizational process for systematically collecting, processing, analyzing, and distributing to decision makers information about an organization's external environment. Such a systematic process organizes the flow of critical information and focuses it on operational and strategic issues and decisions. A system may be formalized in a central department or operated through an informal decentralized association. The terms CI and BI are often used interchangeably. Technically, CI is a subset of BI, focusing on the activities of competitors, markets, and industries. BI, the larger term, covers activities that include the tracking of political, economic, and social forces that affect an organization's ability to effectively compete. Optimally, the system should support BI but most often is limited to competitively defined areas. In this article we will focus on CI.

A CI system may track:

- competitor capabilities, plans, and intentions;
- markets and customers;
- industry structures and trends;
- political, economic, and social forces; or
- technological developments and sources.

The essence of a CI system lies in its function of contributing to better and more timely organizational decision making. Its primary objectives are to help decision makers avoid surprises from the competitive environment and to identify current and potential threats and opportunities. An effective system provides competitive advantage by reducing reaction time to competitive actions and improving both strategic and tactical planning.

CI systems are built on three separate, yet interdependent, activities: (1) general information services, (2) primary information collection, and (3) analysis. Each activity requires different resources and sets of skills and is often performed by separate individuals. These individuals may work directly for the CI organization or be drawn into projects as needed.

The three activities may be viewed as integrated parts of the CI pyramid (see Figure 1). The broadest and most basic activity, information services, identifies, retrieves, and distributes published or secondary information. Published or secondary information sources include commercially published reports, journals, newsletters, studies, and other items—material available through online services such as DIALOG, Dow Jones, and NEXIS. Effective CI information services also track fugitive material from consultants, trade organizations, technical societies, universities, and other sources, for which
bibliographic access is difficult. This category of material is often the most specialized and valuable source of competitive information and is sometimes available by simple request. This kind of service is often provided by an individual with a library background who is on the CI staff or in the organization's library.

The collection activity involves obtaining information from primary sources, usually individuals. These individuals may be employees of an organization or specialists in other companies, consulting groups, universities, or government agencies. Competent information collection of this kind requires an extensive knowledge of interviewing techniques and the ability to develop and maintain a personal information network. Effective collectors often have journalism or investigative government backgrounds. The activity of collecting information in this way is also called "human intelligence" or "humint." It is extensively used in government and security agency operations.

Analysis is the most specialized competitive intelligence activity. It integrates information supplied by the information services and collection activities with an analyst's expert knowledge. Information
is analyzed in a specific environment of problems, transformed into “intelligence,” and delivered to decision makers. Analysts, who frequently possess advanced subject degrees, have extensive knowledge of industries and technologies.

**INTELLIGENCE INFORMATION**

Intelligence information is data about an organization’s external environment compiled through a continuous systematic collection process. This information is obtained from both internal and external information sources and analyzed in concert with an organization’s internal data. Intelligence information provides as complete and as accurate an understanding of the external environment as possible and helps minimize the uncertainty associated with managerial decisions.

In most situations, both primary and secondary information must be analyzed, which is often a team effort, before it becomes intelligence. However, there are situations in which the very acts of identifying and transmitting a piece of information can transform it into intelligence—without additional analysis (Chitwood, 1994). In order to be considered intelligence, it must be relevant to the decision at hand and must support an action or decision. Unfocused or “nice-to-know” information is not appropriate in CI activities. Intelligence information may identify:

- new information about customers or suppliers;
- research and development activities in the industry;
- changes in competitors’ products, staffing, strategy, or finances;
- mergers, acquisitions, and alliances that rapidly change the industry; or
- structural changes in the market or in national political and economic systems.

To provide maximum benefit to a decision-maker, intelligence information must be relevant, delivered quickly, and presented in a way that facilitates rapid comprehension. Intelligence is actionable information. Major problems arise when managers receive information that:

- arrives too late to be factored into a decision;
- is irrelevant to the critical issues;
- obscures trends, ratios, and other relationships; or
- arrives without commentary, context, or explanations.

**COMPETITIVE INFORMATION SYSTEMS**

Competitive information systems (CIS) help managers to stay abreast of market, competitive, and world events. Often information
technology (IT) is used to help organizations keep ahead of their competition. However, CIS does not simply deliver large amounts of information; it provides information for informed decisions. The key to a successful implementation is facilitating the systematic collecting of intelligence information. This function is often translated into computerizing the process. The two processes are often and incorrectly used synonymously. Creating and using an automated tool for its own sake, without considering the required applications of an entire system, is not the same as establishing a systematic program of intelligence information collecting.

Understanding the Existing Information Flow

A good competitive information system works with an organization's other existing information systems wherever they may be: the executive suite, the marketing department, or sales offices. Because many of these systems were designed largely to produce paper reports and to support a different set of managerial decision needs, they can be awkward to work with. It is important to spend time early in the CIS design process to learn about these systems and to complement their activities. An organization's structure can often make identifying these systems difficult, particularly across divisions or geographic lines. However, because a CIS requires access to all available information, it is essential to understand where this business-critical information exists, where it travels, and, most importantly, who creates, controls, and uses it.

Before starting the competitive information systems design, many organizations first complete an information audit. Stanat (1993) suggests specific procedures for such a process, which can identify locations of information creation and modification and paths of information transferral throughout an organization (pp. 79-89). An audit provides a “roadmap” of the information infrastructure and a summary of the uses of the information.

Defining Customers' Key Information Requirements

Because management decisions involve problems that may be complex, unstructured, and may be affected by unpredictable human elements, it is impossible to anticipate all information needs. For this reason, most competitive information systems include highly personalized search and browsing capabilities which draw upon a wide variety of information sources. These systems typically allow users to filter desired information through sets of key criteria based on users' individualized and ever-changing requirements.

Most target CIS customers consider themselves to be effective decision-makers using their own systems of information gathering and analysis. Many resist devoting their limited time and resources
to learning a new system even though they may recognize the advantages of a CIS. To overcome this obstacle, the system must provide some immediate and obvious advantages. Customers will not be motivated to use a system that offers only incremental advantages.

**SUCCESS FACTORS**

Organizations can be extremely complicated, and their environments are even more complex. From organizational culture and management level support to choices of competitive information systems software and long-term maintenance, several major factors have been shown to influence the design and ultimate success of CIS (Hohhof, 1994).

The most important factor affecting the design and operation of competitive information systems is the culture of the organization. To be successful, a system must support operational and cultural changes in progress, but it cannot force them. Many CIS failures can be traced back to cultural incompatibility and organizational conflicts. An organization's culture affects not only how a CIS is used but also the ways in which information is contributed to it. For example, a culture that allows managers to hoard information cannot support CIS. This situation must be changed before a system of intelligence information sharing can be successfully deployed.

If individuals do not make maximum use of information already available on paper, they will not take advantage of information on a computer. If anything, changing the delivery vehicle actually decreases initial use of information because users must learn new procedures. Because of the need to match the existing culture, there currently is no one right system for all competitive intelligence situations. Some existing off-the-shelf systems are easily modified and can be customized to match the organization's unique requirements.

A major determinant of success in competitive information systems development lies in the attitude, efforts, and skills of those managing the system. CIS project managers bridge the worlds of competitive analysis, information processing, computers, and senior management. They must understand their organization's key success factors, possess sound communication skills, and understand information and system design. While many innovative and comprehensive systems are not developed by information technology specialists, there are certain skills and attitudes that are shared by all successful CIS managers:

- competence in competitive analysis, information processing, and senior management;
commitment to a project's mission; and
ability to determine what is important, why it is important, and
to whom it is important.

High level support, while necessary, does not guarantee success. A competitive information system must have a project sponsor at the senior management level, often a vice-president or CEO. He or she provides the system with the high visibility and patronage necessary to develop and maintain the focus and drive of a program. This sponsor also supplies the support and resources to successfully integrate the CIS into an organization's decision-making process. However, in many situations, high-level support that guarantees system success is taken for granted. Although no CIS will prosper without this kind of support, it cannot substitute for deficiencies in planning, implementation, and end-user acceptance.

High-level support must also come from an organization's information services (IS) group or department. An IS sponsor can make the entire automation process significantly simpler and more effective by utilizing the staff's knowledge of existing communication systems and hardware configurations. Organizations are political systems made of individual constituencies with specific requirements, beliefs, and objectives. To be effective, a CIS project must gain the endorsement and support of these various groups. Effective project management ensures that the system meets the actual needs of the organization and its people.

Successful competitive intelligence systems do not require more information, but rather useful detailed information that supports decision making. A successful CIS provides unique information and clearly identifies what it does and does not do. Because information from external commercial print sources can easily be accessed, many systems acquire information from such sources and redistribute it in electronic form, sometimes resulting in an electronic equivalent of junk mail. Additionally, tracking the printed press and newswires will at best keep the organization even with its competitors since every company has equal access to these information sources.

Traditional print and electronic sources support, but do not satisfy, all competitive information needs. Much information about cutting-edge technologies or future technologies, for example, is simply not published. Engineers, scientists, and developers who lead in their fields often do not have the time nor motivation to publish. Not surprisingly, many individuals and companies do not want to write about their progress because this could provide competitors insight into their business strategies.
Basic system assumptions and design decisions should coincide with the target audience's goals. The phrase, "the system passed all acceptance tests, but they (the users) will not use it" often rings true when, after initial consultation and interviews with system customers, project teams create their own assumptions about users' reactions to system designs and capabilities. Even more egregious assumptions occur when project teams assume that the users' goals and requirements coincide with their own views and experiences.

Competitive information systems software is rarely the root cause of system failure. Most failures are caused by inadequately translating an organization's information requirements into an appropriate system. In practice, while software usually functions as specified and rarely is at fault, it usually receives the blame for CIS failure. During system design, the project team can easily become enamored with the software, because a major emphasis at that point is on the use of technology to create a system. However, developers must resist the temptation to add functions simply because the software can support it. The final system should not primarily showcase software capability, but instead meet specific use requirements.

Computer-based systems need to be introduced clearly and carefully to minimize the target customers' resistance to new or different technology. Although the competitive information system is designed to help managers make better decisions, it competes with other demands of time and resources. Many target customers will find it difficult to set aside appropriate time for learning a new system. Increasingly, managers have been forced to learn several new computer systems (such as e-mail, groupware, and Windows) and are suffering from the computer equivalent of jet lag. The CIS must demonstrate to its potential users a substantial and short-term return on their investments of time and effort or risk being avoided or ignored.

A system's value-added contributions must be defined in terms of an organization's expectations requirements. The success of any new system depends heavily on how well the system developers understand their key constituents and how well these users take advantage of intelligence information. Time should be spent identifying the system's primary and secondary customers—who may or may not be the end-users of the information or intelligence provided through the system—and ensuring that their individual needs are met. This is not an easy task. Competitive information system users often have few concrete ideas about what they want the system to do ("I'll know it when I see it"). Even when individuals or organizations provide detailed design criteria, these criteria are valid only for the point in time when they are made. The composition
of the user group will also evolve, so design assumptions must be reevaluated continuously.

System maintenance and information-gathering costs must be confronted at the outset. The ultimate value of a competitive information system should be measured against the total system cost. Plans should include reasonable estimates of all the system's development, maintenance, and information-gathering costs. Unexpected system maintenance costs will appear and increase after the CIS is released, expanded, and enhanced. Under the pressure of meeting schedules and performance milestones, emphasis is often placed on the creation of a system rather than on designing a maintainable one. Although maintenance costs over a system's life are often overlooked, they can far exceed the costs of the original design. Because of resulting unplanned maintenance burdens, a CIS may be discarded before the end of its useful life.

By ignoring the maxim, "imperfection is okay; waiting too long is not," too much time may be spent trying to design a flawless system. An implicit assumption is that a system, once built, will not be altered. As a result, much energy is spent identifying all possible customer needs and evaluating all options. Not only does this consume time, but it can dull a project team's enthusiasm and cause individuals or an organization to lose interest. A CIS does not have to be perfect. If fundamental requirements have been analyzed, focus groups listened to, and environmental restrictions identified, the system will meet its key objectives. Two ways to approach an imperfect situation pragmatically is to: (1) rank the CIS goals based on the affected users and their relative importance to the business, and (2) plan a schedule that quickly delivers the crucial functions and gradually phases in the remainders.

TECHNICAL DEVELOPMENTS

The rising sophistication of computer software and the falling cost of computer hardware have fueled the introduction of automated information retrieval systems into many management processes, including competitive intelligence. The development and implementation of decision support systems (DSS) and executive information systems (EIS) have also accelerated the acceptance of competitive information systems. Pressures to develop such systems have grown during the last decades. Prior to the early 1980s, mainframe computers dominated all corporate computing. Within organizations, all data were collected, analyzed, and distributed on mainframe systems managed by management information (or information technology or information services) departments. These departments became the gatekeepers of information and determined:
how information would be collected;
what information would be collected;
how the information would appear when presented;
where it would be distributed; and
who would have access to it.

A major benefit of this kind of structure was that all data contained within the organization were maintained in a central location. Everyone worked from the same files, which were gathered and organized under uniform processes and procedures. If individuals had access to the central mainframes, they had access to all available computerized information in the organization.

In the early 1980s, personal computers (PCs) began appearing in organizations. Electronic information gathering, analyzing, and distributing became decentralized, and PCs assumed increasingly important roles for storage and manipulation. More sophisticated and powerful PCs eroded mainframes' advantages of internal memory capacity, speed, larger storage, and software availability.

Within only a few years (by the late 1980s), the personal computer made further advances through networking and communications tools, primarily local area networks (LANs), modems, and client-server architecture. Management information systems (MIS) groups began linking individual PCs to each other and connecting them to corporate mainframes. This permitted analysts to use their computers as they wanted, and facilitated the systematic (and centralized) collection of data throughout organizations.

Client server architecture, which can assure both independence and interdependence, is the current solution to fragmentation and decentralization of corporate data. Client-server architecture is a design in which a client (the system's user) accesses a server (or a centralized computer). This architecture interconnects computer hardware to share data throughout an organization, using LANs or wide area networks (WANs), in which two or more LANs are connected. Many organizations are implementing these networks to "reconnect" users throughout their organizations to corporate-wide computer systems. In client-server architecture, the hardware development has outpaced the software. Now that the industry has answered the question, What can be done? they are wrestling with, How do we do it? As a result, the industry is placing increased emphasis on developing groupware. Groupware is software whose central purpose is to inform or coordinate people. Group scheduling programs and workflow automation programs are groupware, because
their principal purpose is to coordinate people or work processes involving people. E-mail, conferencing, and shared-knowledge systems may be considered to be groupware because their core function is to inform people.

**Current System Software**

The pressure is on information systems managers and software developers to supply applications that support critical business functions including competitive intelligence, which at first seem to defy automation. Gains in computerized information services automation augment the basic processes of handling information, filtering it, and distributing it through some intelligence function.

The original text-handling systems developed from government-funded research in the late 1970s. They placed text in unstructured records and retrieved information by matching words and phrases by means of Boolean operators. Large text files could be searched quickly through inverted word indexes. Few major advances have been made in this area since. Many of the current software programs used to support competitive analysis promote their own particular capabilities by developing their own specific terms and definitions. In many cases a software company will place its own "proprietary spin" on an existing industry term to enhance the product's sales appeal and to promote it as something new.

Several information retrieval advances have found applications in competitive intelligence systems. Retrieval speed has been increased, and searching has been linked to customized thesauri or topic trees. Several systems have provided features that allow searchers to "relevance rank" search output by the frequency of search terms in a given text or to assign "weight" to certain search terms according to their relative importance. "Fuzzy" or fault-tolerant searching, an outgrowth of optical character recognition functions, allows words to be accurately retrieved even when misspelled. Natural language processing principles are also being supported by software systems. These provide:

- morphological analysis, the ability to match terms such as "mouse" and "mice";
- syntactic analysis, giving insight into the relationship between words;
- semantic analysis, resolving the different meanings of a single word such as "plant"; and
- natural (user) language interfaces.

**The Next Technology**

The next technology shift may also be generated from government-funded research. This development may be driven by
the increased pressure on government agencies to provide information to U.S. companies, allowing them to become more competitive internationally. As a reaction to this information demand, some government research has turned to developing more sophisticated retrieval systems as alternatives to providing more information directly.

One such new technology is context vectors. Context vectors represent words or documents as numbers, specifically vectors. Vectors for words with similar meanings will point in the same direction. The system is able to learn relationships among words in a training text and exploit such relationships for better precision and recall in text processing. The retrieval process identifies documents with context vectors close to the query context vector.

Text extraction (or message understanding) systems represent another rising technology for competitive intelligence systems. They have developed from finite state automated research and analyze the content of a document, extract lists of data, and place them into structured databases. Such an approach is effective for text-scanning tasks in which only a fraction of the text is relevant. There is a predetermined, relatively simple, rigid target representation into which the information is mapped; subtle nuances of meaning and the writer's goals are of no interest. A sample application would be the tracking of joint ventures in which a manager would want to keep current with a minimum investment of time.

**Developing Competitive Intelligence Cybrarians**

The characteristics of information professionals are changing quickly in competitive information systems environments. The increasing availability of information sources, the wide presence of information technologies throughout organizations, and unrelenting needs for current and changing information at the highest organizational levels (including the needs of competitive intelligence activities) are hastening the evolution of librarians into "cybrarians" (Bauwens, 1993). These new information professionals are librarians who need not rely on physical locations for information resources (or for themselves) in order to provide actionable information. They cultivate close relationships with their clients via electronic networks and provide information through a variety of electronic delivery media to users in a just-in-time fashion.

Electronic delivery media extend beyond the established external information databases; crucial to their success are systems of access to internal information and to internally developed information systems. In support of the demands of organizations' competitive
intelligence activities, and as CI practitioners become more sophisticated information users, the trend toward cybrarianship will accelerate.

REFERENCES


